Assignment 3 : Q1: Report

Question 2 *Reconstructing a Phantom Magnetic Resonance Image*

Part a,b,c,d

Sparse-acquisition transformation model is implemented along with different priors like quadratic, discontinuity adaptive huber function, huber function. Codes for the same can be found in code folder of question 1. "myDenoiser.m" contains the relevant information.

Reporting

Part a

RRMSE between noisy and noiseless image: 0.8111

Part b

Optimal Values for Quadratic Prior

Optimal Value of alpha = 0.231

Description	alpha	RRMSE
alpha_optimal	0.231	0.23359
1.2*alpha_optimal	0.2772	0.23523
0.8*alpha_optimal	0.1848	0.23455

Optimal Values for Huber Prior

Optimal Value of alpha = 1

Optimal Value of Gamma = 0.01216

Description	(alpha,gamma)	RRMSE
alpha_optimal,gamma_optimal	(1,0.01216)	0.1988
1.2*alpha_optimal,gamma_optimal	(1,0.01216)	0.1988
0.8*alpha_optimal,gamma_optimal	(0.8,0.01216)	0.28863
alpha_optimal,1.2*gamma_optimal	(1,0.014592)	0.19889
alpha_optimal,0.8*gamma_optimal	(1,0.009728)	0.20164

Optimal Values for Discontinuity adaptive huber Prior

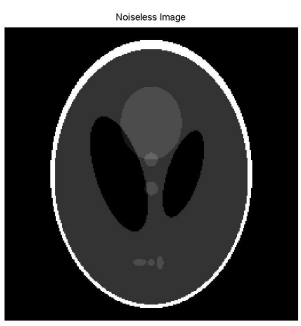
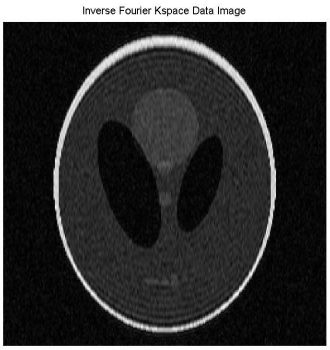
Optimal Value of alpha = 1
Optimal Value of gamma = 0.00512

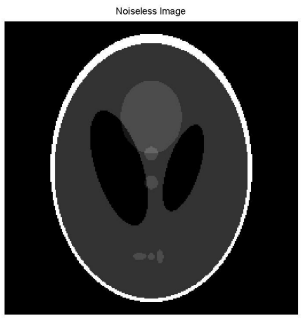
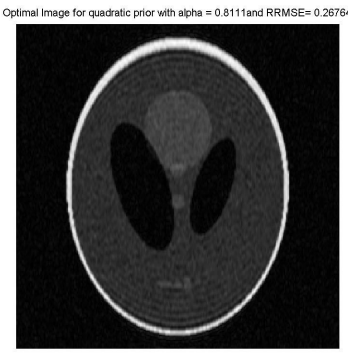
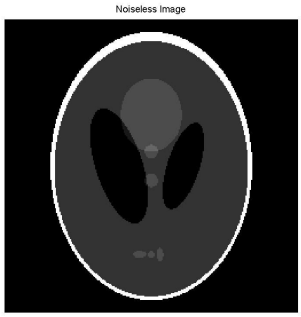
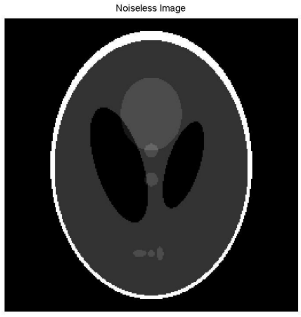
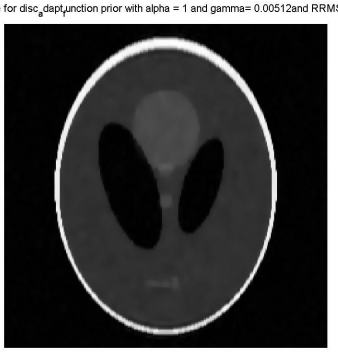
Description	(alpha,gamma)	RRMSE
alpha_optimal,gamma_optimal	(1,0.00512)	0.19931
1.2*alpha_optimal,gamma_optimal	(1,0.00512)	0.19931
0.8*alpha_optimal,gamma_optimal	(0.8,0.00512)	0.2908
alpha_optimal,1.2*gamma_optimal	(1,0.006144)	0.19932
alpha_optimal,0.8*gamma_optimal	(1,0.004096)	0.19966

Looking at the table we can conclude that optimal values are indeed local minima for objective function.

Part c

Corresponding images for Different Type of Prior

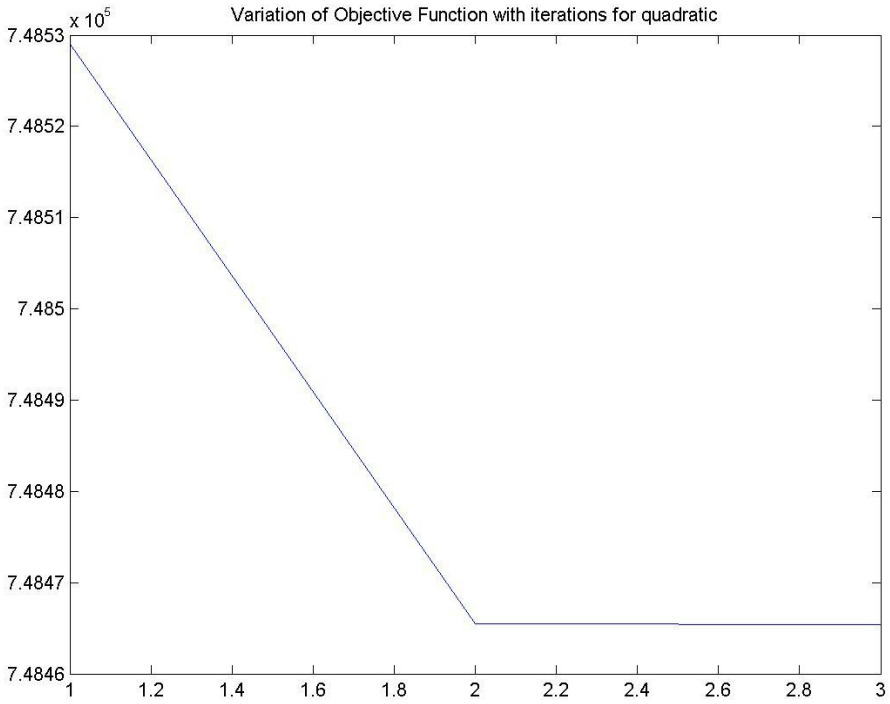
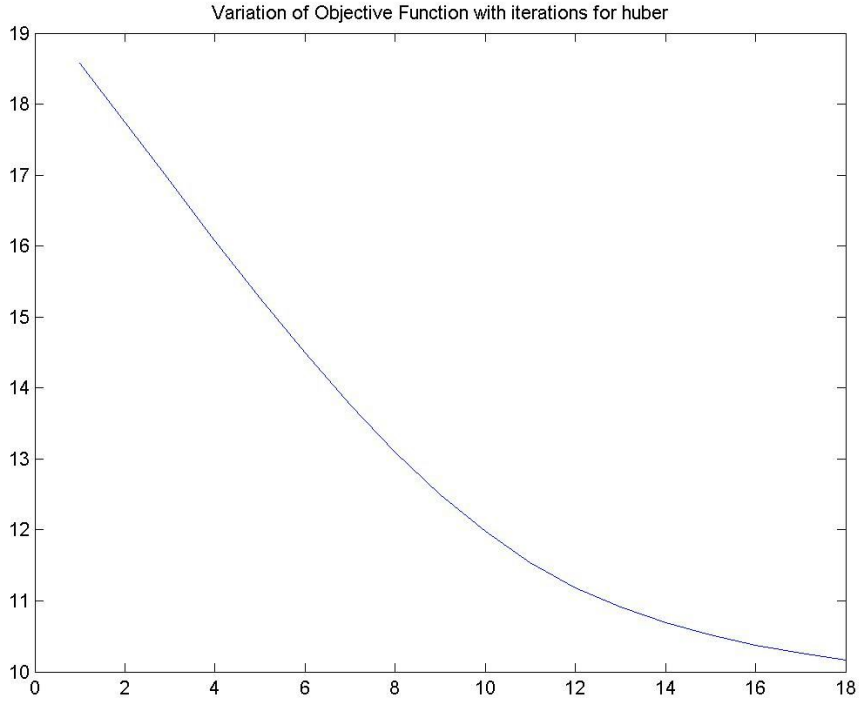
Description	Noiseless	Specific
Inverse Fourier Kspace Data		

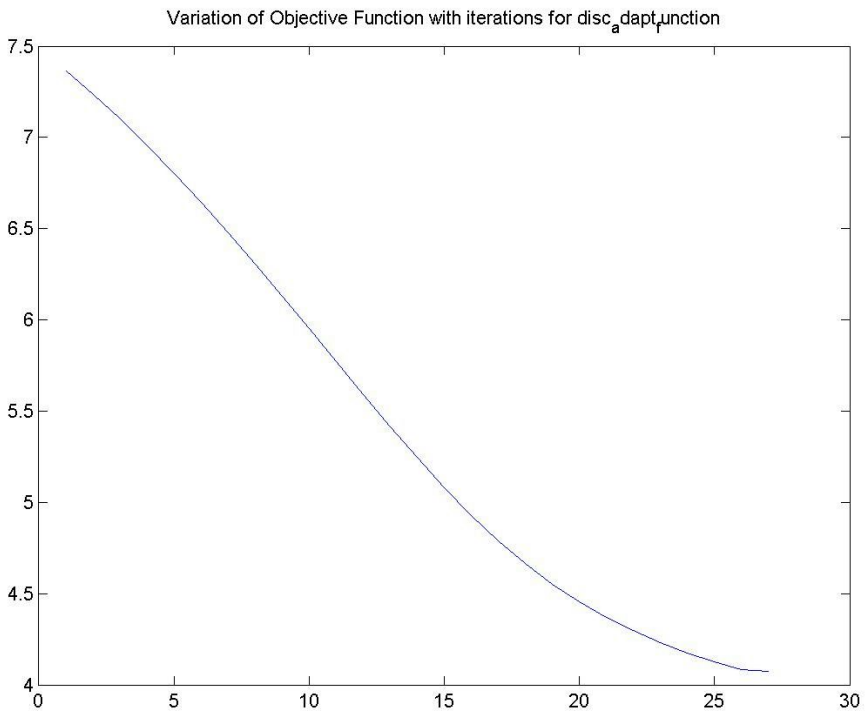
Quadratic Prior		
Huber Prior		
Discontinuity adaptive function Prior		

Part d

Corresponding plots of Objective Function for Different Type of Prior

Prior Type	Plot of log of Objective Function

Quadratic	
Huber	

Discontinuity-Adaptive Huber Prior	

Disclaimer

All the images and corresponding plots in high resolution can be found in ‘images’ folder of question 1. Sub folder are made for different priors and you can locate optimal images and objective function plot. It will be great if you run code section by section